

2.2 Research Personnel

Statistics on research personnel, along with those on R&D expenditures, are another effective indicator of the extent of research activities. Personnel engaged in R&D¹⁴ can be classified as researchers and support personnel (assistant research workers, technicians, and clerical and other supporting personnel).

2.2.1 Researchers

2.2.1.1 Number of Researchers

Countries use different methods for determining the number of researchers. The Frascati Manual defines researchers as “professionals engaged in the conception or creation of new knowledge, product processes, methods, and systems, and in the management of the projects concerned.” But this definition is quite vague, and countries that follow the Frascati Manual also specify their own definitions of the term “researcher” for counting researchers.

For this reason, there are differences between countries in methods for measuring the number of researchers, and international comparisons are difficult. In comparison between Japan and the United States, the number of researchers counted in the Report on the Survey of Research & Development conducted by the Statistics Bureau of Japan’s Ministry of Internal Affairs and Commu-

nications is not exactly equivalent to the researchers counted in the U.S. National Science Foundation’s National Patterns of R&D Resources. Differences of methods for determining the numbers of researchers are shown in Table 2-2-1, and would appear to be obstructing a fair statistical comparison. The category of researcher at universities and colleges, in Japan, consisting of teachers, doctoral students, medical staff, etc., differs between Japan and the United States in the following ways.

(1) Teaching Staff

In 1995, a year in which it’s possible to compare teachers in Japan and the United States, 160,634 teachers at universities and colleges in Japan, including those in the humanities and social sciences, were classified as researchers, while in the United States only the 89,300 university and college teaching personnel who responded that they had obtained a doctoral degree and were primarily engaged in research were classified as researchers—a smaller result than in Japan.

It would appear, then, that the number of teaching personnel in the United States who are involved in research is much larger than in Japan when the same kind of statistics are used. On the other hand, if the same statistical method used in the United States were applied to Japan, the number of Japanese researchers would be smaller.

14 • Research personnel: “Report on the Survey of Research and Development” compiled by the Statistics Bureau classifies personnel engaged in R&D as follows. (2002 revision)

- Researcher: Persons who hold a university degree (or persons who have equivalent or greater knowledge in their specialty), who are engaged in research activities in their own chosen subject. “Researchers” as used herein, refers only to full-time researchers, and excludes those who also perform other duties in addition to research.
- Assistant research workers: Persons who assist researchers and who are engaged in research activities under their direction and who have the possibility of becoming researchers in the future.
- Technicians: Persons, other than researchers and assistant research workers, who are engaged in technical services related to research activities under the guidance and supervision of researchers and assistant research workers.
- Clerical and other supporting personnel: Excepting those mentioned above, persons who are engaged in miscellaneous activities, clerical work, accounting, etc., relating to research activities. Japanese statistics on persons engaged in R&D are as of April 1 of the appropriate year up to 2001, and as of March 31 for 2002.

Table 2-2-1 Comparison of Japanese and U.S. definitions of researchers

Country	Japan (until 2001)	United States
Companies	<ul style="list-style-type: none"> • Have university graduate (or higher) qualifications • Two years or more of research experience • Have a research theme in which conducting research • Researchers calculated by FTE 	<ul style="list-style-type: none"> • University graduate level, or have equivalent or higher level of expert knowledge • Engaged in research themes • Researchers calculated by FTE
Private research institutions	<ul style="list-style-type: none"> • Have university graduate (or higher) qualifications • Two years or more of research experience • Have a research theme in which conducting research • Researchers calculated by FTE 	<ul style="list-style-type: none"> • People who have Ph.D.s, and who state that they are mainly engaged in research and development • Actual number of researchers (head count)
Government research institutions	<ul style="list-style-type: none"> • Have university graduate (or higher) qualifications • Two years or more of research experience • Have a research theme in which conducting research • Researchers calculated by FTE 	<ul style="list-style-type: none"> • People who have Ph.D.s, and who state that they are mainly engaged in research and development (excluding military-related personnel) • Actual number of researchers (head count)
Universities and colleges	<ul style="list-style-type: none"> • Teachers, enrolled doctoral students, medical staff, or those who have university graduate (or higher) qualifications • Two years or more of research experience • Engaged in research themes (including teaching staff) • Actual number of researchers (head count) (FTE values are also reported to the OECD) 	<ul style="list-style-type: none"> • People who have Ph.D.s, and who state that they are mainly engaged in research and development, and university graduates engaged in research assistance • Actual number of researchers (head count), excluding graduate students • Graduate students are FTE converted with a 50% coefficient

Note: In Japan, categories were changed during a 2002 survey revision to “Business enterprises,” “non-profit institutions,” and public organizations.” The requirement of “two years or more of research experience” was cut.

Source: Japan – Ministry of Internal Affairs and Communications, Statistics Bureau (Statistics Bureau). "Report on the Survey of Research and Development"

United States – National Science Foundation. "National Patterns of R&D Resources: 2002 Data Update"

(2) Number of Graduate School Students

A comparison for 1999 reveals that 59,057 people who were studying in doctoral courses, including the humanities and social sciences, in Japan were classified as researchers. This figure is virtually identical to the 1999 figure of 59,007 graduate school students in doctoral courses counted in the Ministry of Education, Culture, Sports, Science and Technology’s “Handbook of Education, Culture, Sports, Science and Technology Statistics (2003 edition).”

In the United States, however, the number of graduate school students receiving remuneration for research assistance work is 91,308 people (NSF, “Science and Engineering Indicators 2002”), which is reduced by the FTE (Full-Time Equivalent) rate coefficient of 50% to arrive at a total of 45,700 researchers. In the United States, therefore, while the count extends beyond doc-

toral courses to include people in Master’s course programs as well, it is limited to students who are engaged in research assistance work, and is further reduced by a predetermined coefficient. Thus, it is highly probable that the estimate for number of researchers would yield a lower result than Japan’s method of including all students engaged in doctoral course programs.

Therefore, when making comparisons between Japan and the United States, it is important to remember that the measurement of researcher numbers in Japan is overestimated, primarily at the universities. In 2002, the Ministry of Education, Culture, Sports, Science and Technology conducted a “Survey of Full-time Equivalency Data at Universities and Colleges,” the results of which will be used in the future to estimate the number of researchers.

As a result, while there may be differences in the methods of measuring researcher numbers, it

is useful, however, to look at general trends for each country from its own methods. The United States had the largest number of researchers (1999: 1,261,000), followed by Japan, at 757,000 (2002: 646,000 using FTE), and Germany (2001: 264,000) (Figure 2-2-2).

The total number of researchers in Japan increased by 0.75% in FY2002 over the previous year (4.3% using FTE), and was followed by a

year-on-year increase of 0.13% in FY2003 (-4.34% using FTE). However, the 2002 survey included revised sections (expansion of surveyed industries, a changed survey date, and an altered definition of researchers, etc.). The annual average rates of increase since 1983 (using FTE) were 4.58% from 1983-1988, 3.91% from 1988-1993, 4.40% from 1993-1998 and 3.01% from 1998-2003.

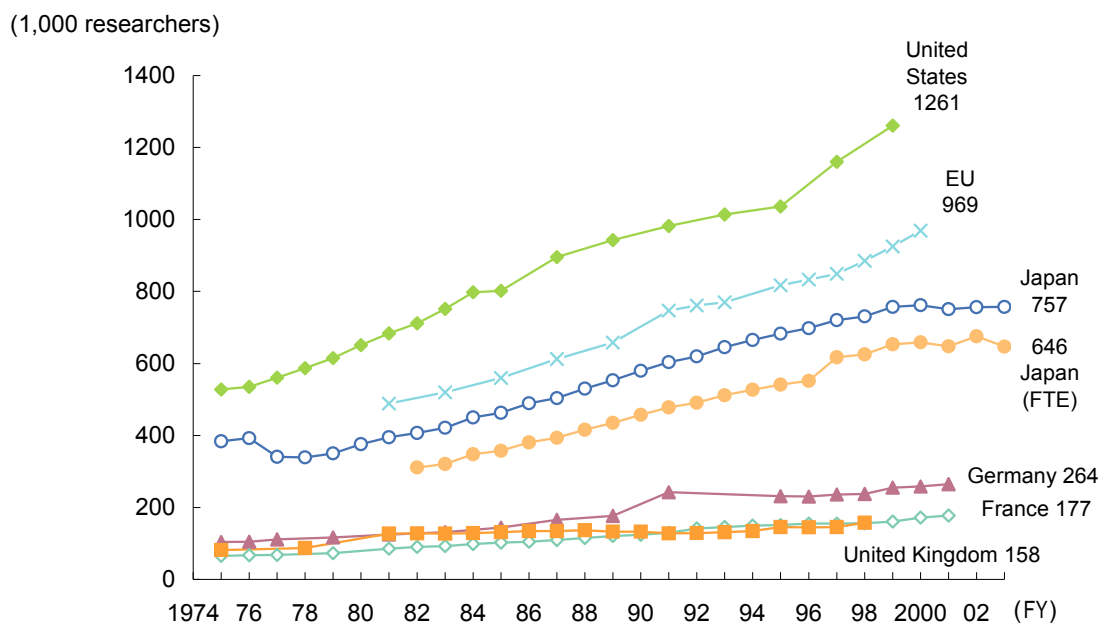


Figure 2-2-2 Trends in numbers of researchers in selected countries

- Notes:
1. The figures for all countries include social sciences and humanities.
 2. The statistics for Japan also show number of researchers in natural sciences only.
 3. Japan's FTE values prior to 1996 are OECD estimates.
 4. In Japan, the software industry has been covered in the survey since FY1997 and the wholesale industry since FY2002.
 5. U.K. figures through 1983 show total number of researchers in industrial (scientists and researchers) and national institutions (degree-holding researchers and above), and do not include universities and private research institutions.
 6. EU (12 countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain) figures are OECD estimates.

Source: Japan: Statistics Bureau. "Report on the Survey of Research and Development"

Japan (FTE values), United States, France, United Kingdom, and the EU: OECD, "Main Science and Technology Indicators," Germany: Federal Ministry of Education and Research, "Faktenbericht Forschung"

(See Appendix 3. (1))

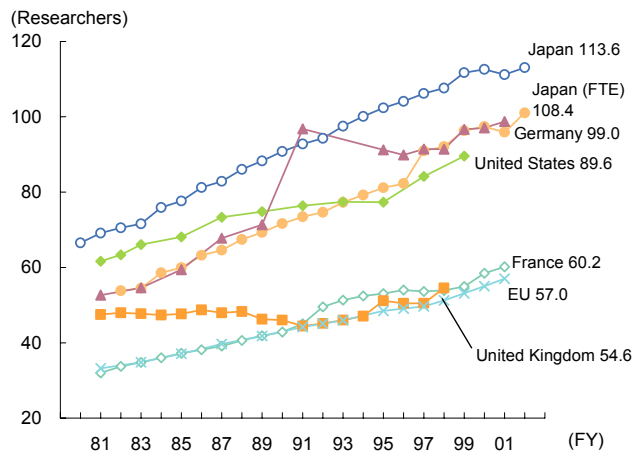
2.2.1.2 Number of Researchers per 10,000 Population and per 10,000 Laborers

In Japan, the number of researchers per 10,000 people was 59.3 in 2003, while the number of researchers per 10,000 people was 113.6, the

highest figures among the advanced nations (Figure 2-2-3).

But the trends in recent years show that the numbers of researchers per 10,000 people and per 10,000 laborers have been stagnant in Japan since about FY2000.

(1) Number of researchers per 10,000 people



(2) Number of researchers per 10,000 labores

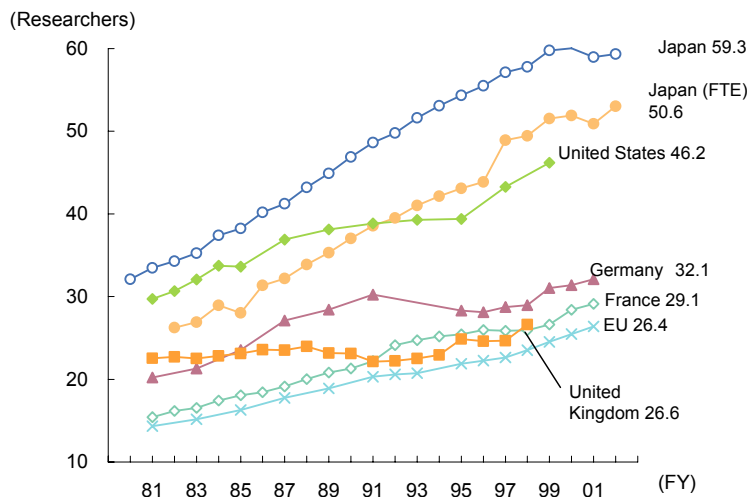


Figure 2-2-3 Trends in numbers of researchers per 10,000 people and 10,000 laborers

Notes: 1. The figures for all countries include social sciences and humanities. The statistics for Japan also show the data for researchers in natural sciences only.

2. Figures for Japan's labor force and number of researchers are as of April 1 of each year.

3. EU figures are OECD estimates.

Source: Number of researchers data: Same as in Figure 2-2-2.

Population and labor force data:

Japan – Statistics Bureau. "Population Estimates Series", "Monthly Report on the Labor Force Survey"

Other countries – OECD. "Main Science and Technology Indicators," "National Accounts"

(See Appendix 3. (1))

2.2.1.3 Number of Researchers by Sector

As for the number of researchers by type of organization, industry (companies) had the most in Japan at 56.9% of the total, followed by universities and colleges at 37.1% and government research institutions (public institutions) at 4.5%.

The United States has a greater percentage of researchers working in industry, and the percentage of researchers in its government research institutions is low, similar to Japan. In Europe, meanwhile, research personnel are concentrated to a high degree in government research (Figure 2-2-4).

The following sections show the characteristics of researchers in Japan by sector.

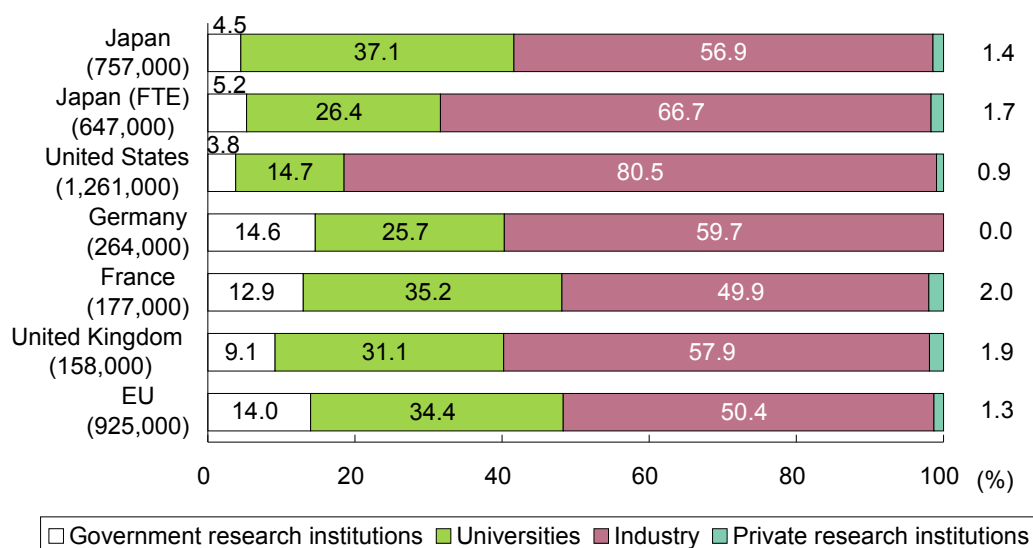


Figure 2-2-4 Share of researchers by sector in selected countries

Notes: 1. For the comparison, statistics for all countries include research in social sciences and humanities. Statistics for Japan, as of March 31, 2002, include the FTE value for public institutions, universities and colleges, companies, and nonprofit organizations.

2. Japan's FTE values are Statistics Bureau data.

3. The data are estimates for Japan in 2003, the United Kingdom in 1998, the United States and the EU in 1999, and Germany and France in 2001.

4. Data for private research institutions in Germany is included in data for government research institutions.

Source: Japan -- Statistics Bureau. "Report on the Survey of Research and Development"

Others -- OECD. "Main Science and Technology Indicators"

2.2.1.3.1 Business Enterprises

In the last five years from 1998 to 2003 (with 2002 using the revised survey), the number of researchers in business enterprises increased by 6.6% (an average annual rate of increase of

1.30%, from 404,000 researchers to 431,000), which, while slowing, is still increasing compared to other organizations. This hints that industry, as well, has come to place great importance on research and development (Figure 2-2-5)

As for the number of researchers by type of industry, the information and telecommunications machinery and equipment industry registered the highest number, followed in order by the automobile industry, the machinery industry, the electronic machinery, equipment and supplier industry, the chemicals industry other than pharmaceuticals (a total of three industries), the electronic parts and devices industry, the pharmaceuticals industry, and the information and telecommunications industry (Figure 2-2-6).

As for the number of researchers out of 10,000 employees, except for academic research institutions, the information and telecommunications machinery and equipment industry had the largest number, at more than 2.8 times higher than the average for all industries, followed in order by

the electronic applications and electrical instrument industry, the precision equipment industry, the oils and paints industry, and the general chemicals and chemical fibers industry, in all of which more than one employee in 10 is fully engaged in R&D (Figure 2-2-7).

By field of research, engineering ranks the highest. Next is physical science, followed by health, and finally agricultural sciences. Within the engineering field, researchers are concentrated in “electrical and telecommunications engineering,” and “mechanical engineering, ship-building and aeronautical engineering.” Within the physical sciences, chemistry has the majority. These three fields employ more than three-fourths of all Business enterprises researchers (Figure 2-2-8).

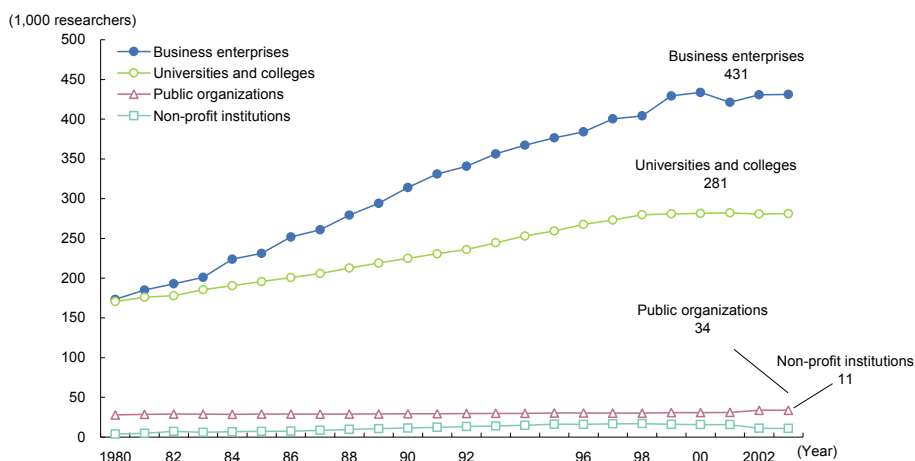


Figure 2-2-5 Trends in numbers of researchers by sector in Japan

- Note: 1. Numbers include researchers in the humanities and social sciences and are as of March 31 of each year, except for FY2001, which is as of April 1.
2. Survey categories were changed in FY2002; numbers up to FY2001 are for researchers whose primary duty is research at the following organizations (except at universities and colleges, where the number includes those who conduct research as an additional post).

Up to FY2001	FY2002
Companies	enterprises
Private research institutions	Non-profit institutions
research institutions	Public organizations
Universities and colleges	Universities and colleges

Source: Statistics Bureau. "Report on the Survey of Research and Development"
(See Appendix 3. (8))

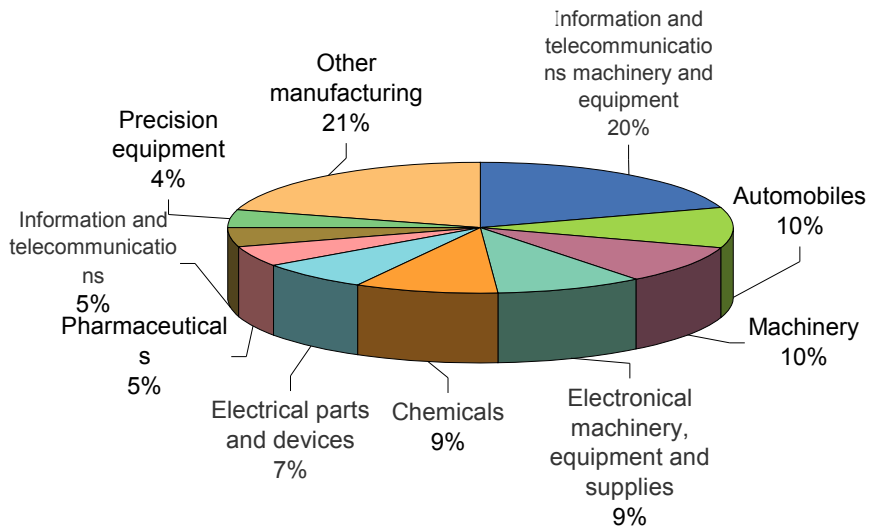


Figure 2-2-6 Researchers at business enterprises, by type of industry (2003)

Source: Statistics Bureau. "Report on the Survey of Research and Development"

(See Appendix 3. (9))

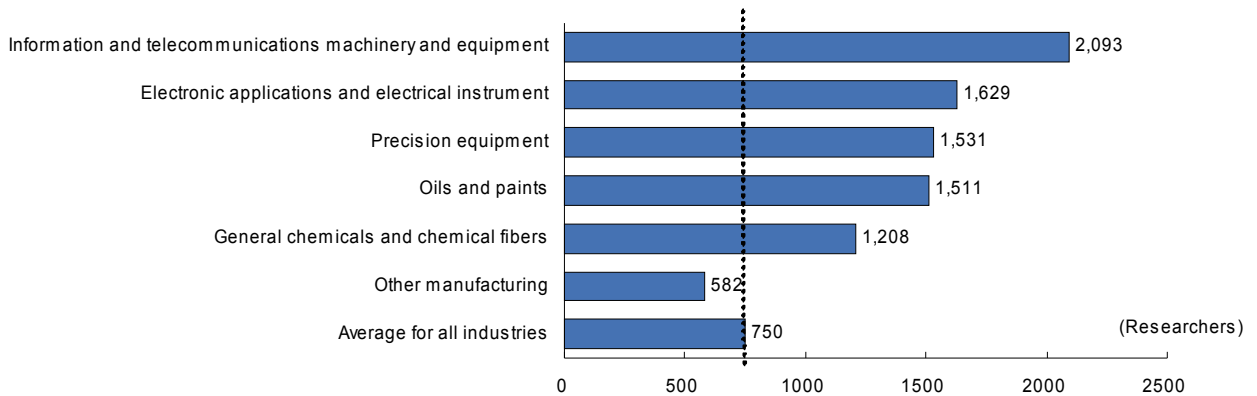


Figure 2-2-7 Number of researchers per 10,000 employees at business enterprises (top five industrial categories except academic research institutions) (2003)

Notes: 1. Regarding researchers per 10,000 employees, the data for number of employees and number of researchers are as of March 31, 2003.

2. Academic research institutions (5,697 researchers per 10,000 employees) are not shown on graph.

Source: Statistics Bureau. "Report on the Survey of Research and Development"

(See Appendix 3. (9))

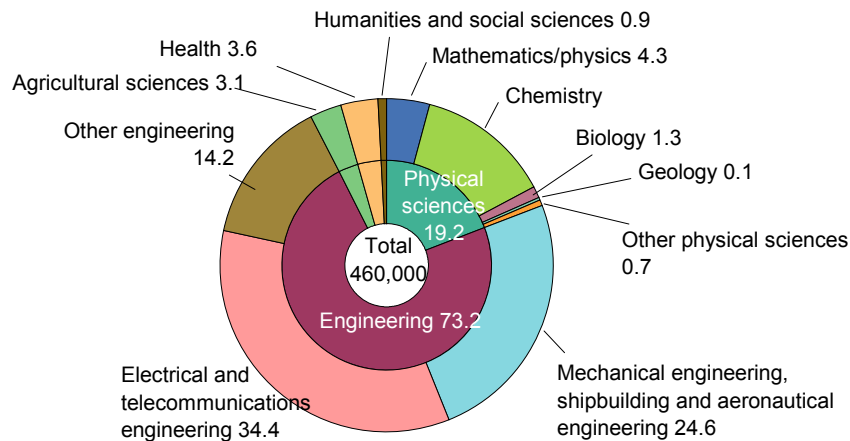


Figure 2-2-8 Composition of number of business enterprises researchers by field of research (2003)

Note: Figures are their shares in percentages to total company researchers.

Source: Statistics Bureau. "Report on the Survey of Research and Development"

2.2.1.3.2 Non-profit Institutions and Public Organizations

A chronological comparison of the number of researchers is made difficult by the transformation of national experimental research institutions into incorporated administrative agencies, in addition to the revision of the Statistics Bureau's

"Survey of Research and Development." However, the number of researchers stands at 11,000 in non-profit institutions and within public organizations, at 3,300 in national institutions, 14,500 in local government-owned institutions, and 16,100 in public corporations and incorporated administrative agencies (Figure 2-2-9).

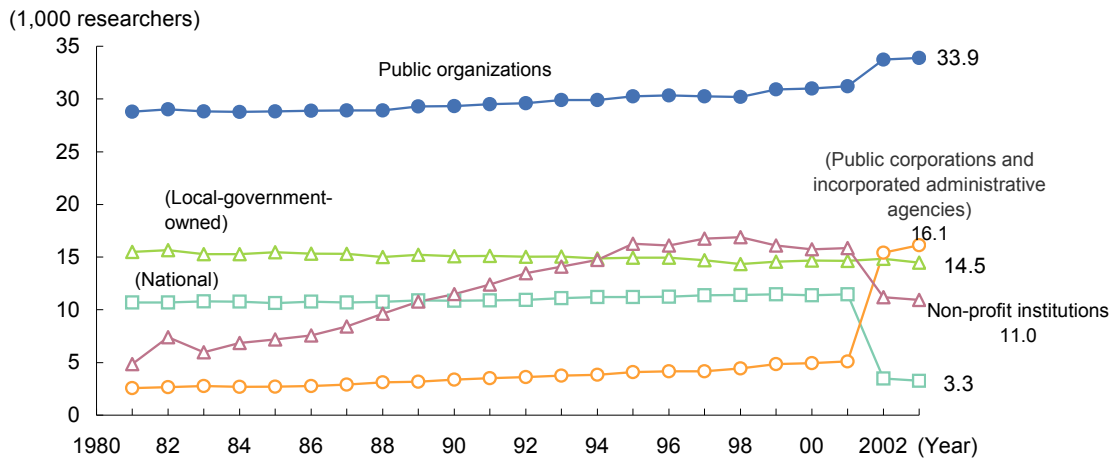


Figure 2-2-9 Trends in the numbers of researchers in nonprofit organizations and public institutions

- Notes: 1. Numbers include researchers in the humanities and social sciences and are as of April 1 of each year, except for FY2003, which is as of March 31.
 2. Survey coverage categories were changed in FY2002; numbers up to FY2001 for non-profit institutions use the values of private research institutions.
 3. Values up to FY2001 are for researchers whose primary duty is research.

Source: Statistics Bureau. "Report on the Survey of Research and Development" (See Appendix 3. (8))

When looking at sector composition, a disproportionately large share of researchers was seen in engineering at non-profit institutions and among public organizations, in health and engineering at national institutions, in agricultural

sciences at local government-owned institutions, and in engineering and the physical sciences at public corporations and incorporated administrative agencies (Figure 2-2-10).

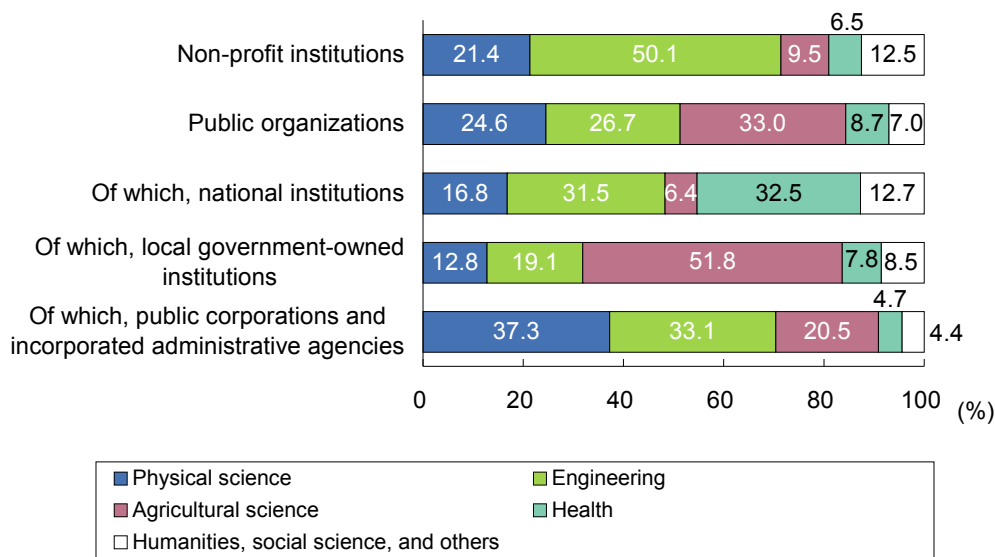


Figure 2-2-10 Composition of researchers in non-profit institutions and public organizations by organization and field (2003)

Note: The number of researchers is as of March 31, 2003.

Source: Statistics Bureau. "Report on the Survey of Research and Development"

2.2.1.3.3 Universities and Colleges

The number of researchers at universities and colleges, including those in the humanities and social sciences, has increased by 0.6% in the last five years (1998-2003, an average annual rate of increase of 0.12%) up to 281,000 researchers from 280,000. Looking at the number of researchers by type of institution in 2003, private

universities and colleges have 131,000 researchers, the largest portion of the total researchers at universities and colleges, followed by national universities and colleges (128,000), after which comes local public universities and colleges (22,000) (Figure 2-2-11). However, in terms of researchers whose primary role is research, the order becomes national universities (122,000), followed by private universities (117,000), and then local public universities (18,000).

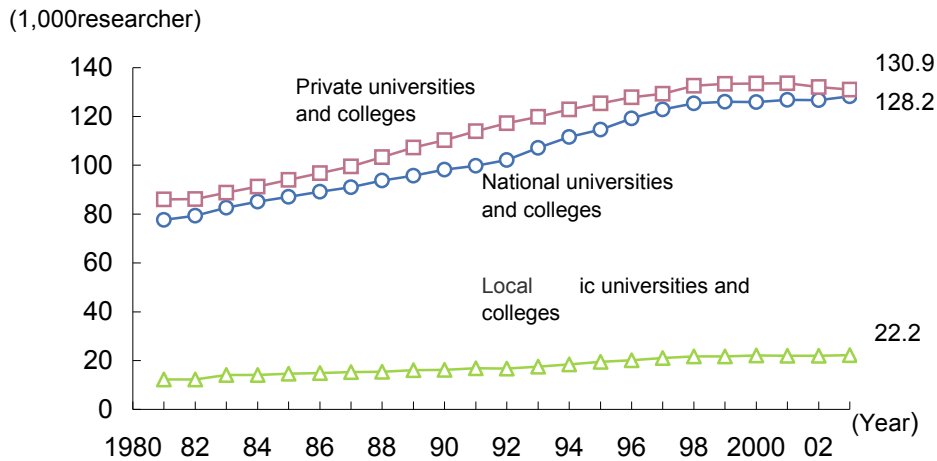


Figure 2-2-11 Trends in numbers of researchers in universities and colleges

Note: Numbers include researchers in the humanities and social sciences and are as of April 1 of each year, except for FY2003, which is as of March 31.

Source: Statistics Bureau. "Report on the Survey of Research and Development" (See Appendix 3. (8))

Researchers in universities and colleges consist of faculty members, doctoral students, medical staff and others. Looking at the composition of researchers by type of institution, in national universities and colleges, doctoral students make up a large ratio of the researchers, and private uni-

versities and colleges have a greater ratio of teachers and medical staffs and a smaller ratio of students for doctoral degrees. The figures for public universities and colleges fall in between those for the national universities and the private universities and colleges (Figure 2-2-12).

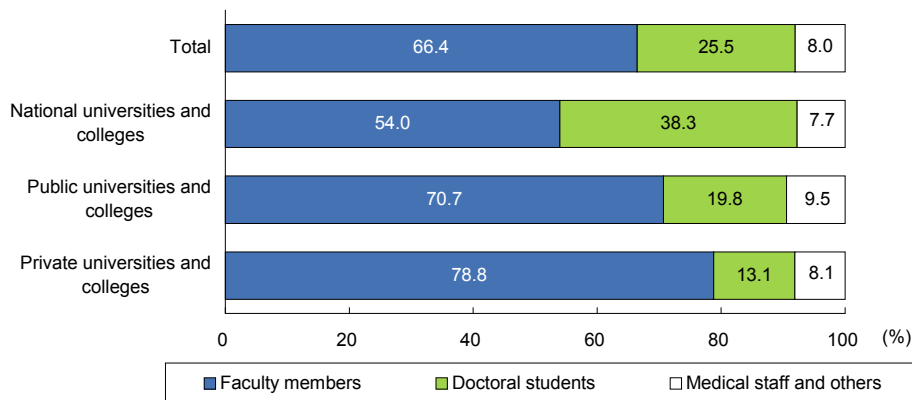


Figure 2-2-12 Composition of researchers in universities and colleges (2003)

Note: Numbers include researchers in the humanities and social sciences as of March 31, 2003.

Source: Statistics Bureau. "Report on the Survey of Research and Development"

By sector composition, a large share of university researchers were health specialists, whether faculty members, doctoral students, or medical staff. Other sectors with relatively high shares of

the total were engineering, for teachers, and science, for students in doctorate programs (Figure 2-2-13).

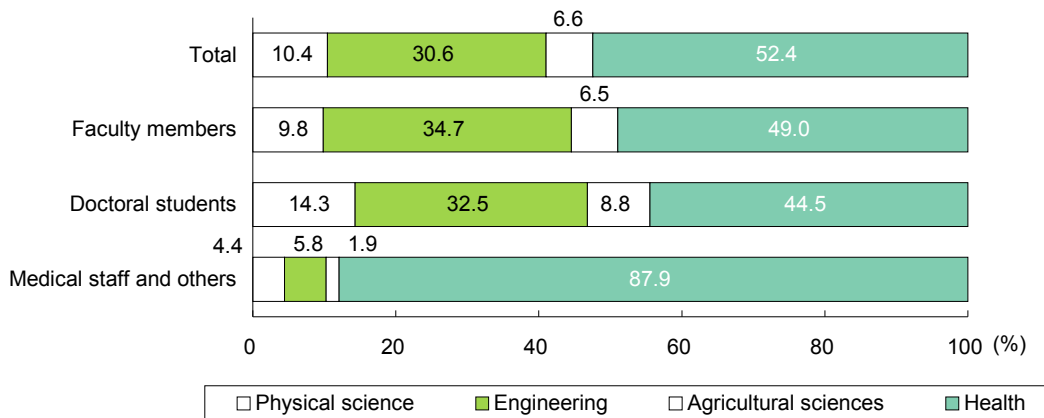


Figure 2-2-13 Share of researchers in the natural sciences at universities and colleges by field (2003)

For the number of researchers by academic field in the most recent five-year period (1998-2003), balanced annual growth rates are seen in the physical sciences (at 0.16%), engineering (at 1.85%), and agricultural sciences (at 1.03%), while the health sciences registered a decline of an average annual rate of 1.47% (Figure 2-2-14).

Looking at specific sectors, the electrical and communications sectors (average annual growth rate of 2.76%) and civil engineering and architecture (average annual growth rate of 2.04%) are showing particularly fast increases in the number of researchers (Figure 2-2-15).

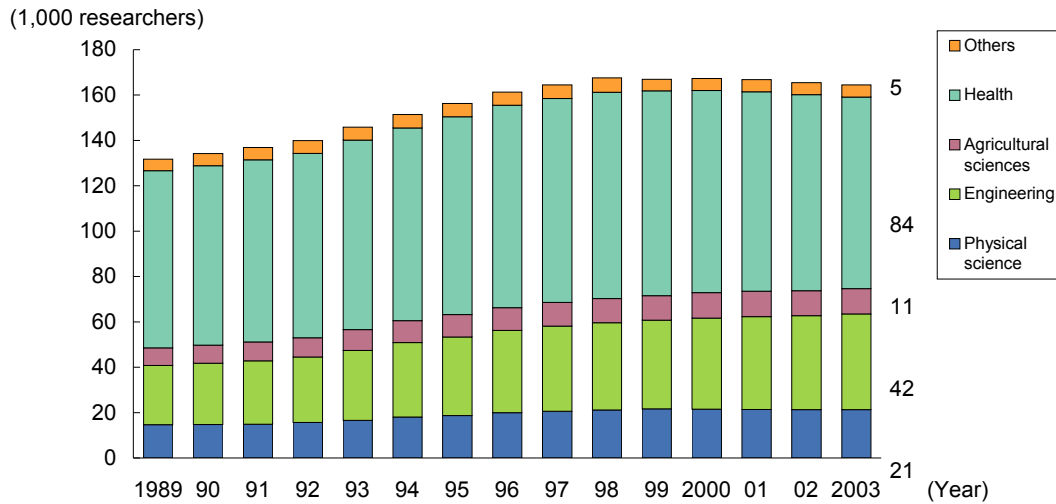


Figure 2-2-14 Trends in the numbers of researchers at universities and colleges (five fields)

Note: The number of researchers is for the natural sciences only and is as of March 31 of each year, except for FY2003, which is as of April 1.

Source: Statistics Bureau. "Report on the Survey of Research and Development"

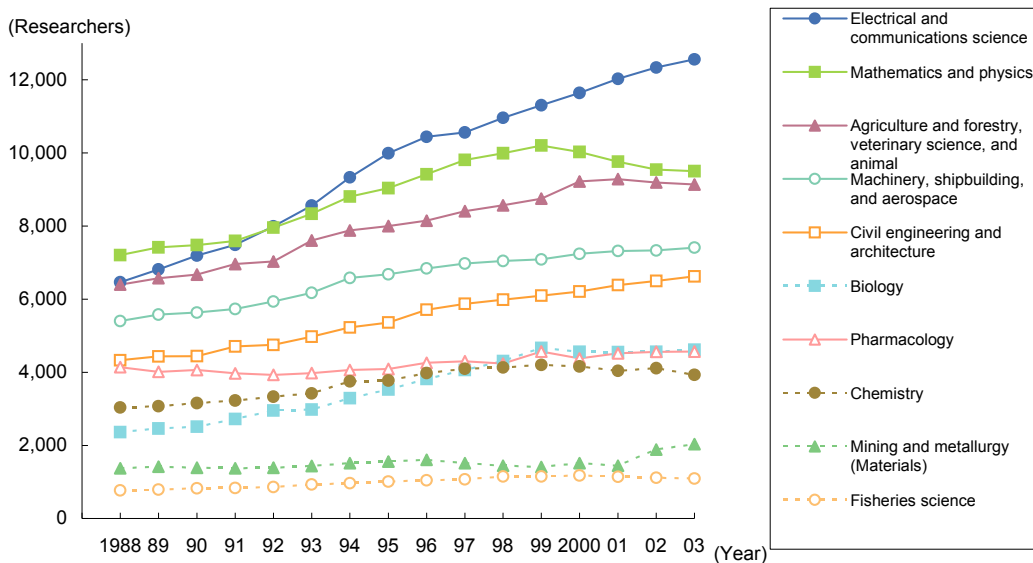


Figure 2-2-15 Trends in the number of researchers at universities and colleges (ten fields)

Notes: 1. The number of researchers is for the natural sciences only and is as of March 31 of each year, except for FY2001, which is as of April 1.

2. "Mining and metallurgy" was changed in FY2002 to "materials," to which was added materials engineering, raw materials engineering, and materials process engineering, etc.

Source: Statistics Bureau. "Report on the Survey of Research and Development"

2.2.1.3.4 Women Researchers

Women researchers, including those in the humanities and social sciences, have steadily increased year by year, reaching 89,000 in 2003, representing about 11.2% of the total number of researchers (Figure 2-2-16). But looking at all workers, 25.97 million women employees accounted for 41.1% of the total of 63.16 million employees in Japan in 2001, according to the “Labor Survey of the Ministry of Internal Affairs

and Communications.” It is clear that the ratio of women engaged in the R&D field remains lower than that of women in the labor market in general. The proportion of women researchers by type of organization was 5.9% at companies, etc., 8.8% at non-profit institutions, 11.5% at public organizations, and 19.9% at universities and colleges, clearly demonstrating that universities and colleges provide women researchers more opportunities than elsewhere.

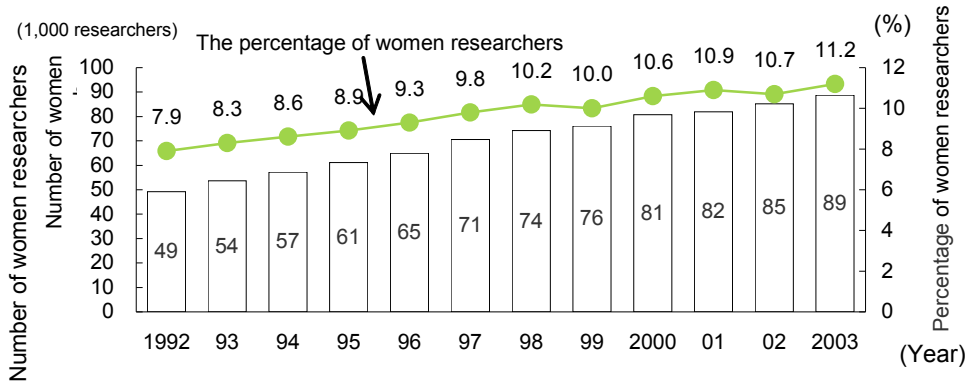


Figure 2-2-16 The percentage of all researchers that are women

Note: Numbers include researchers in the humanities and social sciences and are as of March 31 of each year, except for FY2001, which is as of April 1.

Source: Statistics Bureau. "Report on the Survey of Research and Development"

2.2.2 Personnel Engaged in R&D

The definition of personnel engaged in R&D, which includes both regular researchers and research support staff, varies in scope from one country to the next, so that simple comparisons are probably untenable. Nevertheless, in just such a comparison with the selected countries of Europe, Japan had the largest number of personnel engaged in R&D at 968,000, followed in order by Germany, France, and the United Kingdom.

Japan has relatively low numbers of personnel who are engaged in R&D but are not researchers themselves, with 0.28 research support staff for each researcher, a figure that is one-third the

standard for European nations (Figure 2-2-17). Moreover, even if Japan's researchers are counted according to the FTE method, the number of people engaged in research is 892,000 (of which researchers number 676,000), and the number of research support staff is slightly higher, yet still low, at 0.32 per researcher.

The number of research and development-related workers in Japan showed a year-on-year decline in FY2000, and a 3.1% decline in the most recent five-year period (1998-2003). The downward trend in the number of research assistants was strengthened in the same five-year period, declining by 21.5%, an annual average of -4.8% (Figure 2-2-18).

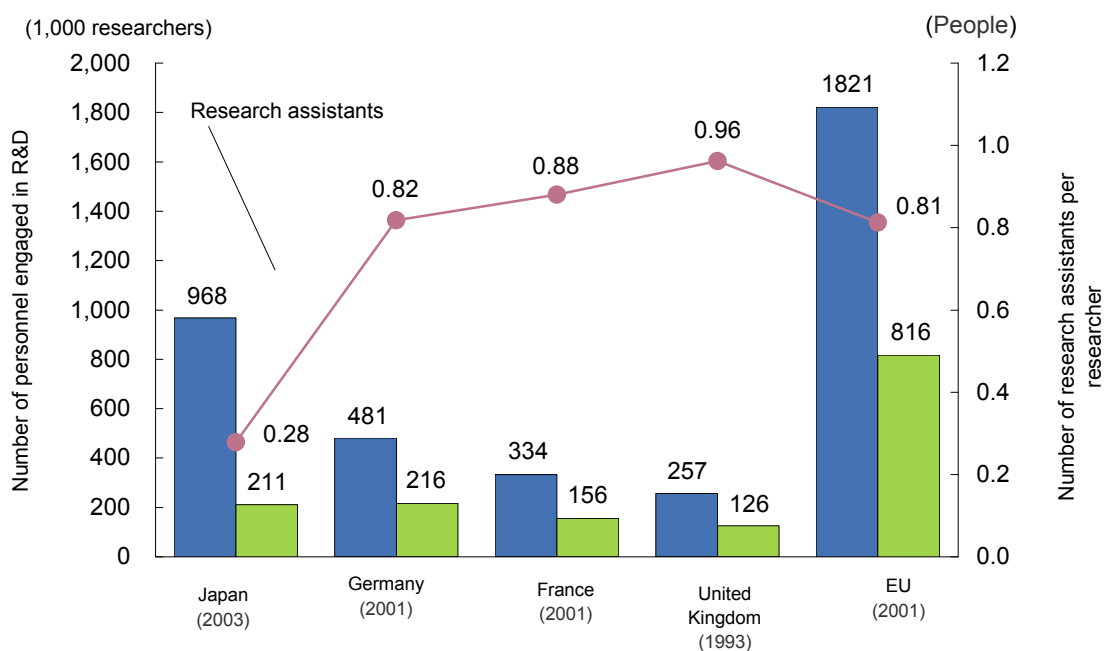


Figure 2-2-17 Number of research assistants per researcher in selected countries

Notes: 1. For comparison, figures for all countries include social sciences and humanities.

2. Figures for EU are OECD estimates.

3. Research assistants refers to people who assist researchers, people who provide technical services that add value to research, and people employed in research administration, which in Japan is referred to as assistant research workers, technicians, and clerical and other supporting personnel.

Source: Japan — Statistics Bureau. "Report on the Survey of Research and Development"

Others — OECD. "Main Science and Technology Indicators"

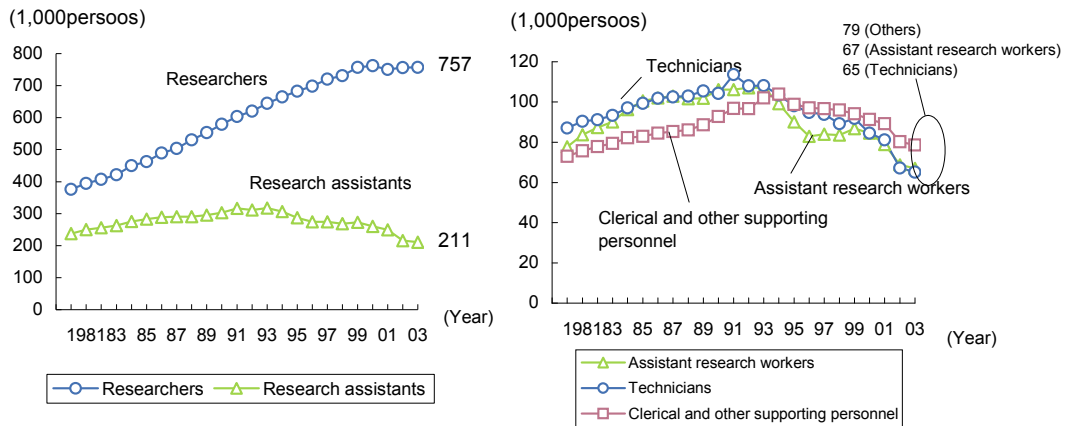


Figure 2-2-18 Trends in persons engaged in R&D in Japan

Note: Numbers include personnel in the humanities and social sciences and are as of March 31 of each year, except for FY2001, which is as of April 1.

Source: Statistics Bureau. "Report on the Survey of Research and Development"
(See Appendix 3. (7))

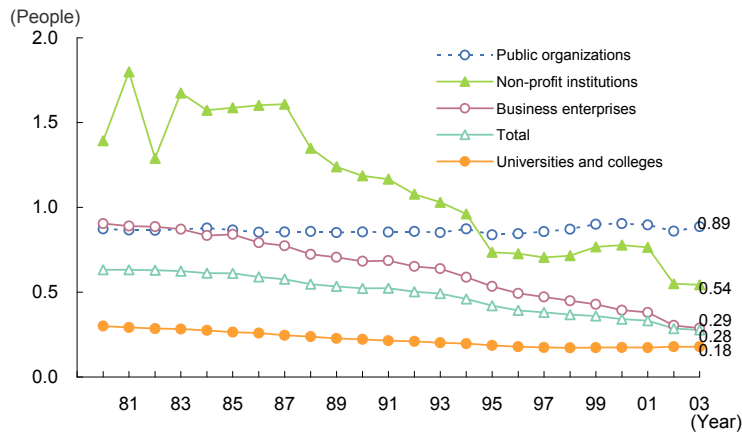


Figure 2-2-19 Trend in the numbers of research assistants per researcher in Japan

Notes: 1. The numbers of researcher and research assistants include those in the humanities and social sciences and are as of March 31 of each year, except for FY2001, which is as of April 1.

2. Survey categories were changed in FY2002; numbers up to FY2001 are for researchers at the following organizations:

Up to FY2001	FY2002
Companies	Business enterprises
Private research institutions	Non-profit institutions
Government research institutions	Public organizations
Universities and colleges	Universities and colleges

Source: Statistics Bureau. "Report on the Survey of Research and Development"
(See Appendix 3. (7))

The percentage of researchers of all personnel engaged in R&D has increased from 73.1 % in 1998 to 78.2% in 2003. On the other hand, the share of assistant research workers decreased from 8.4% to 6.9%. The percentage of technicians decreased from 8.9% to 6.7%. Clerical and other supporting personnel have decreased from 9.6% to 8.1%. In this way, the number of research assistants per researcher continues to decrease. However, promotion of the Science and

Technology Basic Plan has curbed the downward trend at public institutions and universities and colleges (Figure 2-2-19).

The composition by organization of the number of personnel engaged in R&D in Japan reveals that all universities and colleges, including both public and private schools, have the lowest number of research support staff per researcher (Figure 2-2-20).

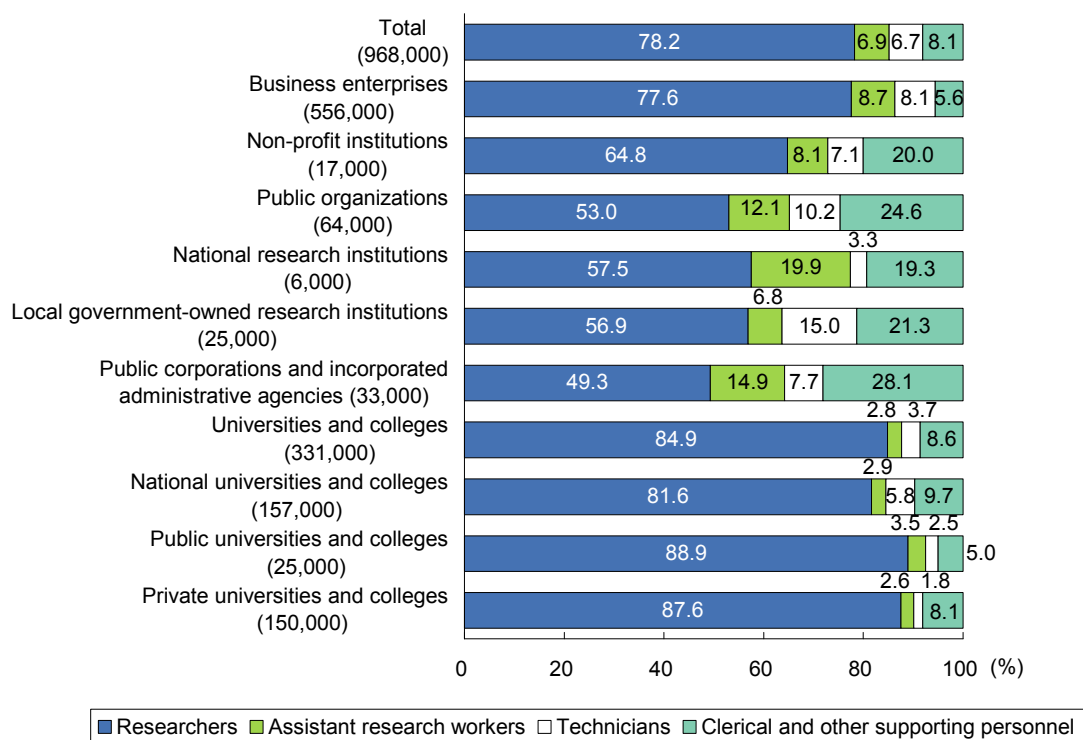


Figure 2-2-20 Composition of personnel engaged in R&D by sector in Japan (2003)

Note: Numbers for all personnel engaged in R&D include those in the humanities and social sciences and are as of March 31, 2003.

Source: Statistics Bureau. "Report on the Survey of Research and Development"

2.2.3 Production and Employment of Research Personnel

2.2.3.1 Overall Degree Trends

The number of people acquiring a master's degree or doctoral degree in the natural sciences in Japan has been rising alongside an expansion of graduate schools. While the number of doctorates decreased in FY1999, those conferred in FY2000 exceeded those conferred in FY1998. During the five-year period from FY1995 to FY2000, the number of master's degrees conferred rose by 1.26 times (average annual growth rate of 5.1%), and the number of doctorates by 1.12 times (average annual growth rate of 2.3%) (Figure 2-2-21). Looking at degrees by major for FY2000, the engineering field accounted for the largest number of new master's degree holders at 26,957, while the largest number of new Ph.D.s was in the health science field at 7,053.

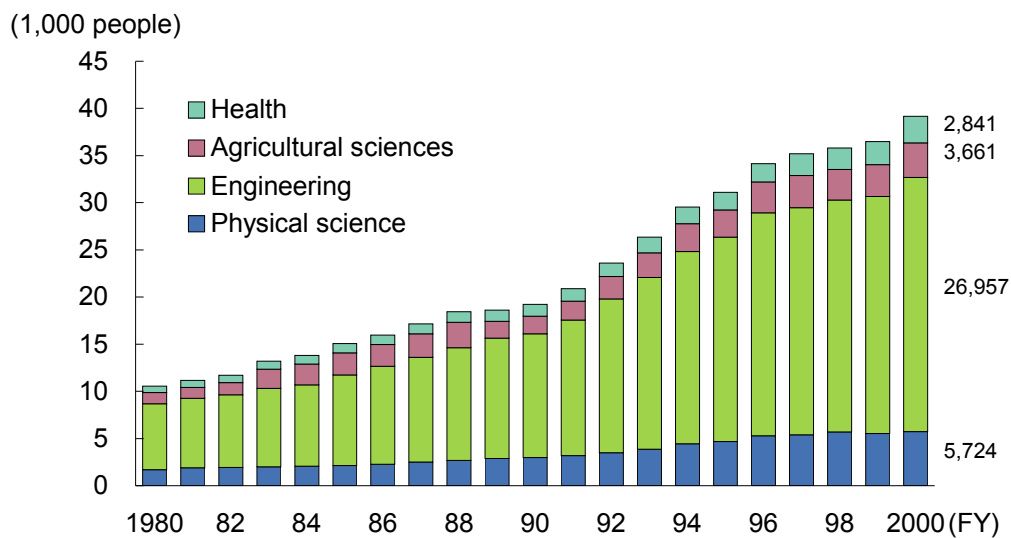
Master's and doctoral degrees differ from country to country due to differences in culture and educational systems. Social factors such as industrial structure and numbers of students can

affect the number of awarded degrees. Thus, it is difficult to compare the data at face value. It is useful, however, to compare trends, and this section describes the degree trends in the natural sciences and engineering in selected countries.

The United States awards the largest number of degrees, a little over three times as many as does Japan. Compared to 1980, the ratio of engineering and health science degrees to total degrees has increased. Japan is second in number of degrees awarded, following the U.S., and has a higher ratio in engineering. The United Kingdom, Germany and France follow in the order named. Of these countries, Germany has a higher ratio in the physical science and health science fields, the U.K. is higher in physical science and engineering, and France has a higher ratio of degrees awarded in health sciences (Figure 2-2-22). Also, if we look at doctorates only, the number in physical science fields in Japan is quite a bit lower than in other selected countries.

The number of graduate school students as a proportion of all university students is also lowest in Japan among selected countries (Figure 2-2-23).

(1) Master's degree



(2) Doctorates

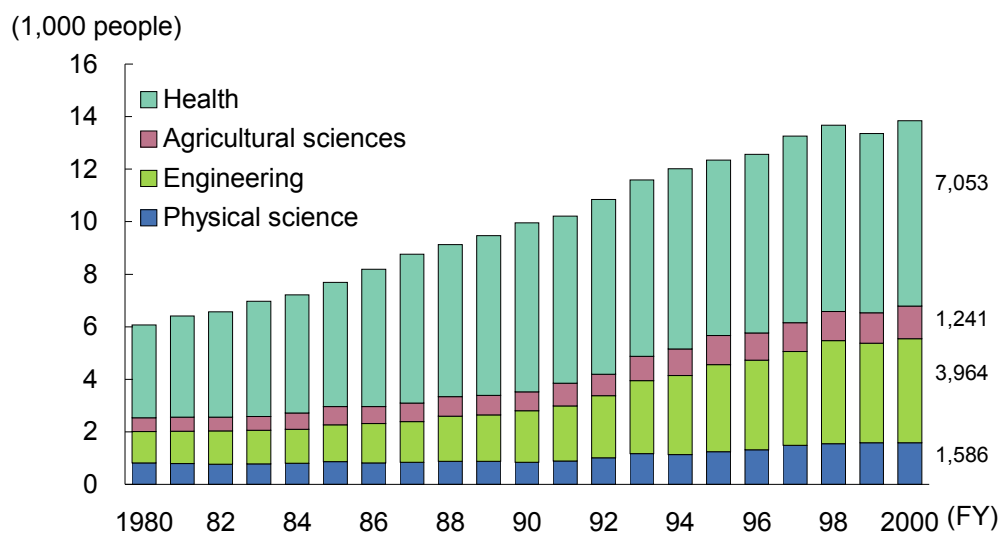
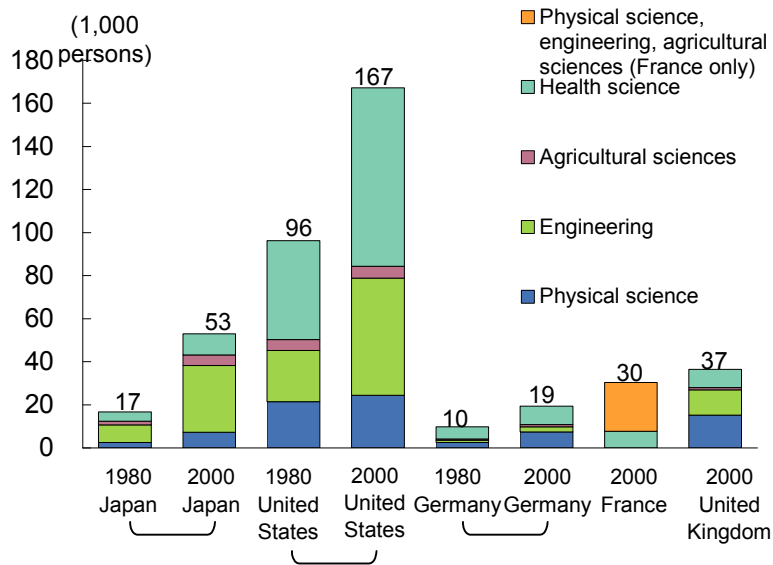


Figure 2-2-21 Degree trends in Japan (natural science)

Note: The figures are awarded degrees in FY2000.

Source: MEXT. "Statistical Abstract of Education, Science and Culture 2004."

(1) Total (awarded at graduate schools)



(2) Doctorates

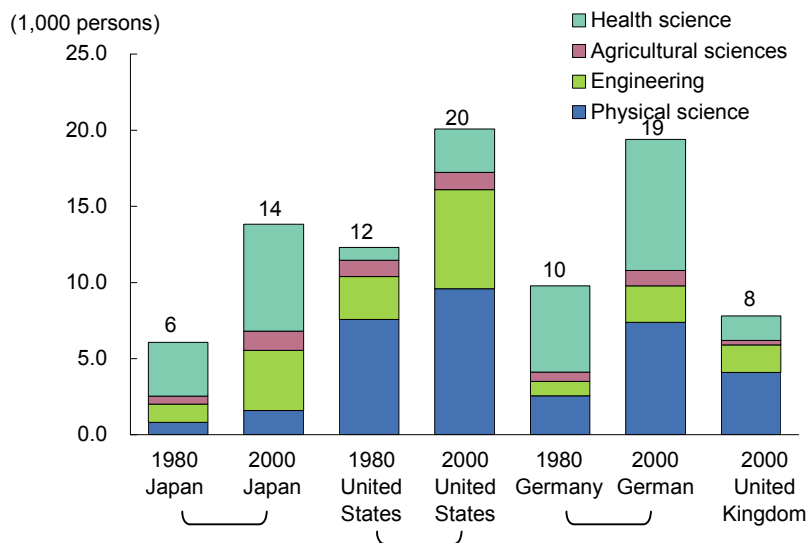


Figure 2-2-22 Number of awarded degrees in selected countries (natural science)

Notes: 1. Totals include master's and doctoral degrees (Germany: only doctorates). U.S. health sciences include first-professional degrees.

2. 1980 data for Germany are for the former West Germany.

3. France does not distinguish between physical sciences, engineering, and agricultural sciences.

Source: MEXT. "International Comparison of Education Indexes 2003, 2004."

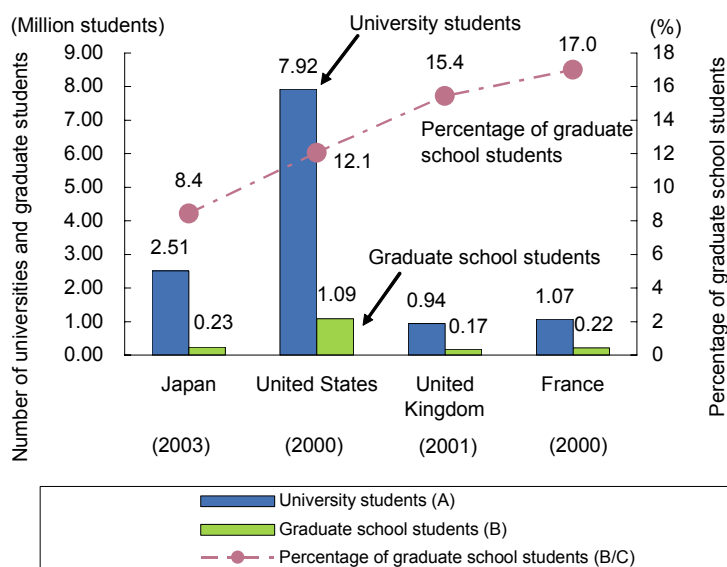


Figure 2-2-23 Number of graduate and university students, and percentage of graduate school students in selected countries

Note: Numbers for the United States and the United Kingdom are for fulltime students.

Source: MEXT. "International Comparison of Education Indexes 2004"

2.2.3.2 Employment of Research Personnel

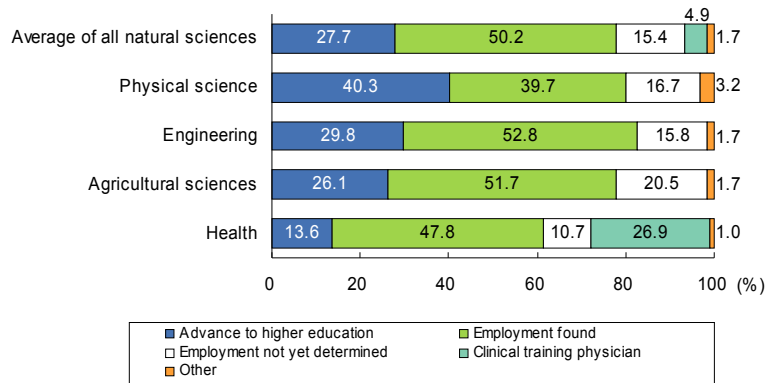
In order to enable the utilization of the skills of research personnel who have received a university and/or graduate school education, it is important that they be ensured an easy transition into industry or research institutions, etc. following graduation.

Here, we shall look at the employment situation for Japan's research personnel from the viewpoint of careers chosen by people in the natural sciences after graduating from university, or after completing master's or doctoral courses. At the university graduate stage, 40.3% of science specialists continue on to graduate work, a proportion that is higher than other specialties. After completing master's degrees, the proportion of engineering specialists who continue on with education drops (to 8.8%), with the vast majority (82.4%) turning to employment. After completing doctoral courses, a large proportion (about

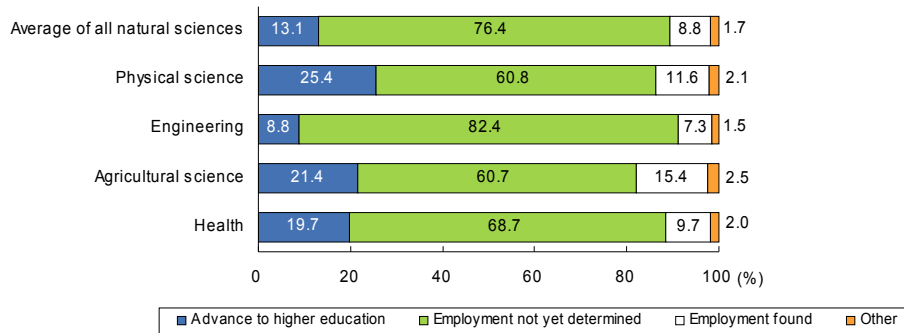
40%) of people in physical science and agricultural science fields do not have definite plans for the time after receiving their doctorates (Figure 2-2-24).

If we look at a number of industries to examine their characteristics in terms of which field of the natural sciences their employees tend to come from, manufacturing industries such as the electrical machinery and tools industry, and the transport machinery and tools industry, consist almost entirely of engineering specialists. By contrast, other manufacturing industries, such as the chemicals industry, take people broadly from all four fields: the physical sciences, engineering, agricultural sciences, and health sciences. In addition, while the electrical machinery, tools manufacturing and other manufacturing industries have a high proportion of personnel who have completed master's courses, they also have an exceptionally low proportion of people who have completed doctoral courses (Figure 2-2-25).

(1) Upon university graduation



(2) Upon completion of master's degree



(3) Upon completion of doctor's degree

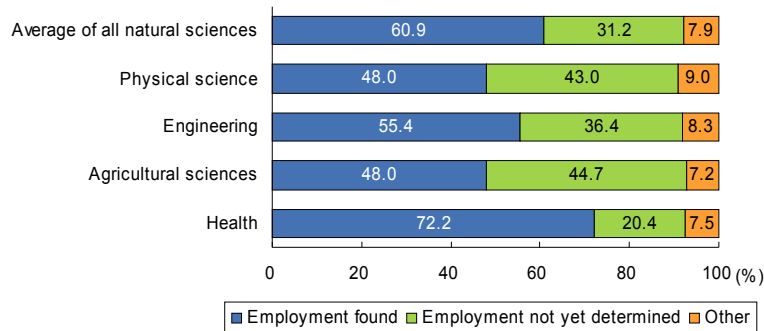
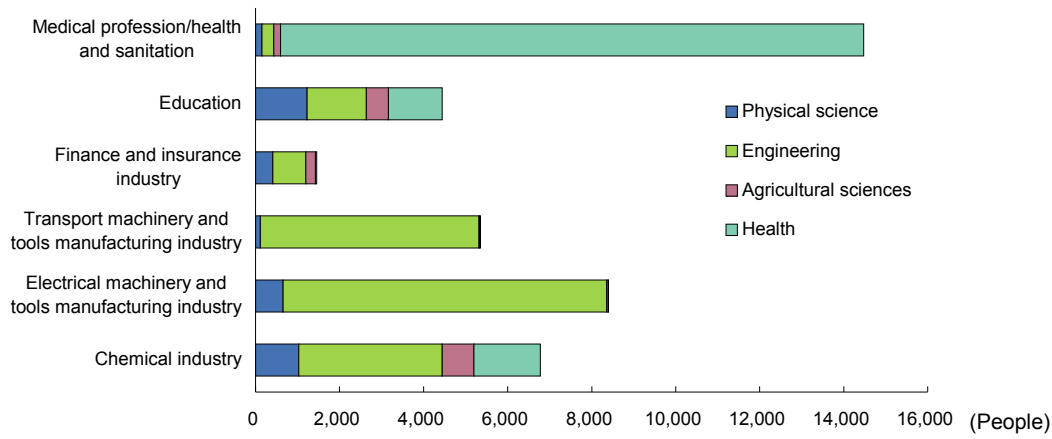


Figure 2-2-24 Trends in career choice, by university degree level (March 2003)

- Notes: 1. "Average of all natural sciences" is the average value of physical science, engineering, agricultural science, and health.
 2. "Employment not yet determined" refers to people who are employed in a temporary work, engaged in housework, are still at school working as a researcher, have entered a technical school or other type of school, a school in a foreign country, or an employment skills development facility, etc., or are clearly neither engaged in any employment nor enrolled in advanced education.
 3. "Other" for those who have completed a master's degree refers to people who are deceased or unidentified.
 4. "Other" for those who have completed a doctor's degree refers to people who have advanced to higher education, are engaged in clinical training to be a physician, or who are deceased or unidentified.

Source: MEXT. "Basic Survey Report on Schools 2003."

(1) By academic field



(2) By academic degree

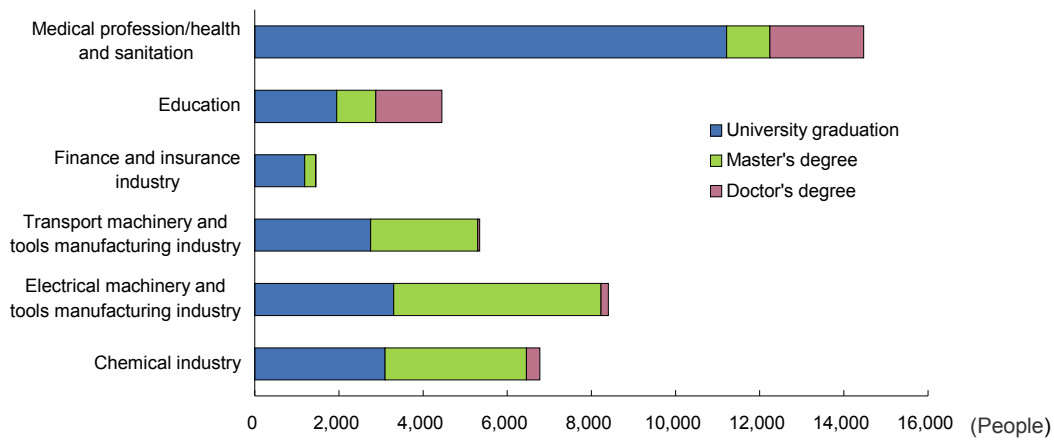


Figure 2-2-25 Employment situation in major industries, by academic field and by degree (March 2003)

Source: MEXT. "Basic Survey Report on Schools 2003"